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FORM PTO-1390 US DEPARTMENT OF COMMERCE REV. 5-93PATENT AND TRADEMARK OFFICE TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		ATTORNEYS DOCKET NUMBER P01,0340
		U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 10/070031
INTERNATIONAL APPLICATION NO. PCT/DE00/01025	INTERNATIONAL FILING DATE 03 APRIL 2000	PRIORITY DATE CLAIMED 21 APRIL 1999 and 21 DECEMBER 1999
TITLE OF INVENTION INSERTION HEAD WITH A TWISTING DEVICE FOR ELECTRICAL COMPONENTS		
APPLICANT(S) FOR DO/EO/US WOLFGANG HUBER, ET AL.		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay. 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of International Application as filed (35 U.S.C. 371(c)(2)). a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US) 6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3)) a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input checked="" type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). Items 11. to 16. below concern other document(s) or information included: 11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; (PTO 1449, Prior Art, Search Report, References). 12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. (SEE ATTACHED ENVELOPE) 13. <input checked="" type="checkbox"/> Amendment "A" Prior to Action. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input checked="" type="checkbox"/> A substitute specification and substitute specification mark-up. 15. <input type="checkbox"/> A change of address letter attached to the Declaration. 16. <input checked="" type="checkbox"/> Other items or information: a. <input checked="" type="checkbox"/> Submission of Drawings, 1 sheet, Figures 1-2. b. <input checked="" type="checkbox"/> EXPRESS MAIL #EL 843744056 US dated October 19, 2001		

JC13 Rec'd PCT/PTO 19 OCT 2001

U.S. APPLICATION NO. (if known use 37 C.F.R. 1.51) 10/070031		INTERNATIONAL APPLICATION NO PCT/DE00/01025		ATTORNEY'S DOCKET NUMBER P01,0340	
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17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO \$890 00 International preliminary examination fee paid to USPTO (37 C F R 1 482) \$710 00 No international preliminary examination fee paid to USPTO (37 C F R 1 482) but international search fee paid to USPTO (37 C F R 1 445(a)(2) \$740.00 Neither international preliminary examination fee (37 C F R 1 482) nor international search fee (37 C.F.R. 1 445(a)(2) paid to USPTO \$1040 00 International preliminary examination fee paid to USPTO (37 C F R 1 482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$ 100 00 <div style="text-align: right;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>				CALCULATIONS		PTO USE ONLY	

Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 C F R 1 492(e))				\$			
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Claims	Number Filed	Number Extra	Rate			
Total Claims	08 - 20 =	0	X \$ 18.00	\$		
Independent Claims	01 - 3 =	0	X \$ 84.00	\$		
Multiple Dependent Claims			\$280.00 +	\$		
TOTAL OF ABOVE CALCULATIONS =				\$ 890.00		

Reduction by 1/2 for filing by small entity, if applicable Verified Small Entity statement must also be filed (Note 37 C.F.R. 1.9, 1.27, 1.28)				\$			
SUBTOTAL =				\$ 890.00			

Processing fee of \$130 00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1 492(f)) +				\$			
TOTAL NATIONAL FEE =				\$ 890.00			

Fee for recording the enclosed assignment (37 C F R 1 21(h) The assignment must be accompanied by an appropriate cover sheet (37 C F R. 3 28, 3 31) \$40 00 per property +				\$			
TOTAL FEES ENCLOSED =				\$ 890.00			

				Amount to be refunded		\$
				charged		\$

a. ☒ A check in the amount of \$ 890.00 to cover the above fees is enclosed.

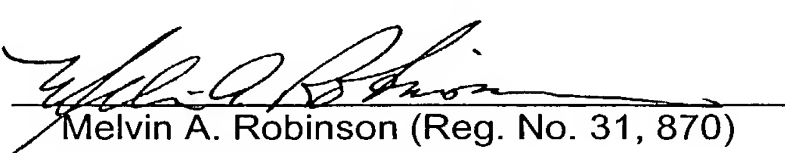
b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-1519. **A duplicate copy of this sheet is enclosed.**

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

SCHIFF HARDIN & WAITE
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Dated: October 19, 2001 Express Mail #EL843744056 US

CUSTOMER NUMBER 26574

BOX PCT

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY – CHAPTER II

**AMENDMENT "A" PRIOR TO ACTION AND
SUBMISSION OF SUBSTITUTE SPECIFICATION**

APPLICANTS(S): Wolfgang HUBER, et al.
ATTORNEY DOCKET NO: P01,0340
INTERNATIONAL APPLICATION NO: PCT/DE00/01025
INTERNATIONAL FILING DATE: 03 APRIL 2000
INVENTION: INSERTION HEAD WITH A TWISTING
DEVICE FOR ELECTRICAL
COMPONENTS

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Applicants herewith submit an amendment and substitute specification in the captioned PCT application, and respectfully request entry of same prior to examination in the United States National Stage.

IN THE SPECIFICATION

Cancel the specification as filed, and insert therefore the substitute specification provided herewith.

IN THE CLAIMS

Cancel claims 1 - 8 as filed, and insert therefore new claims 9 – 16 as follows:

- - What is claimed is:

9. (New) A device for mounting electrical components, the device comprising a turret-like insertion head having at least one precision twisting assembly, a coarse twisting assembly, a stator, and a rotor including a plurality of

circularly distributed grippers for holding the components to be mounted, the rotor being disposed for rotation about a mounting axis, and the insertion head further having an optical measuring device for detecting a position of components held by the gripper, whereby the components to be mounted are twisted into a position approximating a desired mounting position by the coarse twisting assembly before being optically measured, and the components to be mounted are accurately twisted into the desired mounting position by the precision twisting device after being optically measured.

10. (New) The device as claimed in claim 9, wherein the rotor can be twisted step by step with respect to the stator, the optical measuring device serves as a measuring station, and the precision twisting assembly serves as a precision twisting station anchored to the stator.

11. (New) The device as claimed in claim 10, wherein the coarse twisting assembly anchored to the stator serves as a coarse twisting assembly associated with a holding station for the grippers.

12. (New) The device as claimed in claim 11, wherein the gripper includes a slewing ring which can be brought peripherally into frictional engagement with at least one friction surface on the coarse twisting assembly and the precision twisting assembly, and the frictional surface is placed on the slewing ring in a radial direction such that the gripper to be twisted in a tangential relative movement between the coarse twisting assembly, the precision twisting assembly and the slewing ring, whereby the friction surface of the coarse twisting assembly extending along the movement path of the gripper can be twisted together with the rotor and the rolling path on the frictional surface can be varied by a controlled feed of the friction surface onto the slewing ring.

13. (New) The device as claimed in claim 12, wherein the coarse twisting device permits a rotational adjustment of the gripper in coarse basic steps.

14. (New) The device as claimed in claim 12, wherein the frictional surface is formed on a radially adjustable friction block anchored to the stator.

15. (New) The device as claimed in claim 13, wherein the friction surface is formed by a plurality of individually adjustable friction blocks, whose frictional length corresponds to the rotational angle of a basic step.

16. (New) The device as claimed in claim 14, wherein the adjustable friction blocks are shorter than the distance between any two mutually adjacent slewing rings. - -

IN THE ABSTRACT

Cancel the Abstract as filed, and insert therefore on a separate page, the following Abstract of the Disclosure:

- - ABSTRACT OF THE DISCLOSURE

A turret-like insertion head having at least one twisting device for mounting electrical components. The insertion head has a stator, a rotor and an optical measuring device. A plurality of circularly distributed grippers are mounted on the rotor such that the grippers can rotate about a mounting axis. The optical measuring device detects the position of the components held on the grippers, and as a result, a component can be twisted into its approximate mounting position during forward movement of the gripper before making a final position measurement, thereby saving time. - -

REMARKS

A substitute specification and an Abstract of the Disclosure are provided herewith which make editorial changes in order to conform to standard US practice,

pursuant to 37 CFR 1.125(b). A marked-up copy of the specification is also provided reflecting the changes made. No new matter has been inserted.

In addition, the claims as filed have been canceled and replaced by new claims that more clearly set forth the subject matter of Applicants' invention.

No new matter has been inserted into the application.

Applicants submit that this application is in proper condition for examination in the United States National Examination Stage, which action is earnestly solicited.

Respectfully submitted,



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GR 99 P 1689 Version for foreign countries

Description

Insertion head having a twisting device for electrical components

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The invention relates to an insertion head having at least one twisting device for electrical components, the turret-like insertion head having a stator and a rotor, on which a large number of circularly distributed grippers are mounted such that they can rotate about a mounting axis, the insertion head having an optical measuring device for detecting the position of the components held on the grippers, and it being possible for the components to be twisted accurately into the required mounting position by a precision twisting device after being measured optically.

EP-C 0 315 799 discloses providing an insertion device with a moveable turret head, in which the grippers provided with suction pipettes are arranged on a rotor such that they stand out in star fashion. A stator of the insertion head is provided with processing stations distributed circumferentially.

It is usual to design one of these stations as an optical measuring station, in which the rotational position of the component previously picked up is determined. In a subsequent twisting station, the position of the component is changed in accordance with the desired installation position. This change includes a coarse twist, for example in 45° steps, corresponding to the desired installation position, and precision twisting, by means of which the fetching-in accuracy in picking up the components from a feed device is compensated for.

In addition, it is usual to provide the gripper with a disk-like slewing ring of relatively great diameter. On

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said ring, a friction wheel of the twisting device can be placed radially,

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whereupon the twisting device is activated and exact twisting of the gripper through a precalculated angle is effected. Since the components are to be placed onto the printed circuit board in different installation
5 positions, the twisting angle may be so large that the entire twisting cycle lasts longer than the operating cycles on other stations of the turret head, which accordingly limits its insertion performance.

10 The invention is based on the object of reducing the time loss when twisting the grippers.

This object is achieved by the invention as claimed in claim 1. The rotation of the gripper is now distributed
15 to two stages, the coarse twisting being carried out quickly without particular accuracy in a twisting segment before the optical measuring device. As a result, even in the case of a large overall twisting angle, the twisting angle in the precision twisting
20 device can be shortened to such an extent that the precision adjustment does not last longer than, for example, than the optical measurement in the measuring device.

25 Advantageous developments of the invention are characterized in the subclaims.

The development as claimed in claim 2 means that the measurement and the precision twisting of the
30 components take place at a standstill. The measuring station and precision twisting station, and also the coarse twisting station as claimed in claim 3 are fixed to the stator in a simple way and can enter into a precise operative connection with the component or with
35 the gripper.

By means of the frictional surface as claimed in claim 4, the coarse twisting is carried out without any time

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loss during the forward movement of the gripper which
is required in any case. The stationary friction
surface can be formed on a simple constructional part,
on which the slewing ring rolls until the desired end
5 position has at least approximately been reached. The
length of the engagement between the friction surface
and the slewing ring can be terminated accurately by
means of a radial

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feeding movement of the twisting device, for example with the aid of piezoelectric drive elements with a short reaction time, so that the gripper can be twisted through the calculated angle.

5

The development as claimed in claim 5 makes it possible to carry out the coarse twisting with little control effort.

10 The friction block as claimed in claim 6 constitutes a simple component which is easy to operate.

15 The development as claimed in claim 7 makes it possible to design the length of the friction surfaces in such a way that a twisting angle of 45° , for example, is achieved at the gripper in each case. Multiplication of the twisting angle is made possible by an appropriate number of adjustable friction blocks which can be switched into the movement path of the slewing ring.

20 The development as claimed in claim 8 ensures that the grippers with the slewing rings can be moved along a precisely defined path. For example, in the case of a stepper-like turret head with radially projecting grippers, the slewing rings move in one plane, so that
25 the friction blocks can also be arranged in one plane, which is associated with mounting advantages. Shortening the frictional length ensures that each friction surface is in each case occupied by only one slewing ring. As a result, the latter can be twisted
30 differently and individually, as predefined.

In the following text, the invention will be explained in more detail using an exemplary embodiment illustrated in the drawing, in which:

35

figure 1 shows a side view of an insertion head for populating electrical printed circuit boards with components,

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According to figures 1 and 2, a turret-head-like insertion head 1 comprises a stator 2 and a rotor 3. The insertion head can be moved over a printed circuit board 4 and has grippers 5 which project radially in a star-like manner and are provided with suction pipettes, at whose free ends electrical components 6 are held. The rotor can be rotated step by step through an index angle, which corresponds to the pitch angle of the grippers 5. The grippers 5 can be pushed telescopically out of the rotor. The gripper 5 located in the mounting position in each case can therefore place the component 6 on the printed circuit board 4 in the vertical arrow direction shown.

The rotatably mounted grippers 5 are provided with slewing rings 7 shaped like disks. An optical measuring station 8 is used to measure the position of the components 6 with respect to the gripper 5. Fitted to the stator 2, along the movement path of the slewing rings 7, are friction blocks 9, which can be deflected in the horizontal arrow direction to such an extent that their friction surfaces 14 can be placed on the slewing rings 7. When the rotor 3 is twisted, the slewing rings 7 therefore roll with their outer surfaces on the friction surfaces 14 and are accordingly twisted. This twisting takes place in a time-saving manner between the holding stations of the rotor 3. The length of the friction blocks 9 is such that the grippers 5 are in each case twisted through 45°, for example.

By switching the braking-block feed on and off, the gripper can be twisted by any desired multiple of the coarse twisting angle. Following this coarse twisting, the components 6 are measured in the optical station, and their deviation from the installation position is determined. A subsequent precision twisting device 10 is associated with one of the holding stations. In said device, the rotational position of the gripper 5 can be

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changed in fine steps, and the desired installation position of the component can also be corrected.

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The friction blocks 9 are part of a coarse twisting device 11 and are connected to the latter via piezoelectric drive elements 12, which adjust the friction block 9 in the direction of the slewing ring 5 7.

Instead of the coarse twisting device 11 with the friction blocks 8, a coarse twisting station (13), indicated by dash-dotted lines, can also be arranged on 10 the stator of a holding station of the grippers 5, being of the same construction as the precision twisting station 10.

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Patent claims

1. An insertion head (1) having at least one twisting device (e.g. 10) for electrical components (6),
5 the turret-like insertion head (1) having a stator (2) and a rotor (3), on which a large number of circularly distributed grippers (5) are mounted such that they can rotate about a mounting axis, the insertion head having an optical measuring
10 device (e.g. 8) for detecting the position of the components (6) held on the grippers (5), it being possible for the components to be twisted accurately into the required mounting position by a precision twisting device (10) after being
15 measured optically, characterized in that, before being measured, the components (6) can be twisted into a position approximating the mounting position by means of a coarse twisting device (11).
20
2. The insertion head as claimed in claim 1, characterized
in that the rotor (3) can be twisted step by step with respect to the stator (2),
25 in that the optical measuring device is designed as a measuring station (8), and
in that the precision twisting device (10) is designed as a precision twisting station (10) anchored to the stator.
30
3. The insertion head as claimed in claim 2, characterized in that the coarse twisting device anchored to the stator is designed as a coarse twisting station (13) associated with a holding
35 station for the grippers (5).
4. The insertion head as claimed in claim 3, the gripper (5) having a slewing ring (7), which can be brought peripherally into frictional engagement

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with at least one friction surface (14) on the
twisting device (e.g. 10, 11),

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it being possible for the friction surface (14) to be placed on the slewing ring (7) in the radial direction and

5 it being possible for the gripper (5) to be twisted by means of a tangential relative movement between the twisting device (e.g. 10, 11) and the slewing ring (7),

characterized

10 in that the stationary friction surface (14) of the coarse twisting device (11) extends along the movement path of the gripper (5) that can be twisted together with the rotor (3), and

15 in that the rolling length on the friction surface (14) can be varied by means of the controlled feed of the friction surface (14) onto the slewing ring (7).

5. The insertion head as claimed in claim 4, characterized in that the coarse twisting device
20 (11) permits a rotational adjustment of the gripper (5) in coarse basic steps.

6. The device as claimed in claim 4 or 5, characterized in that the friction surface (14) is
25 formed on a radially adjustable friction block (9) that is anchored to the stator.

7. The device as claimed in claim 6, characterized in that the segmented friction surface (14) is formed
30 by a plurality of individually adjustable friction blocks (9), whose frictional length corresponds to the the rotational angle of a basic step.

8. The device as claimed in claim 6 or 7, characterized in that the friction surfaces (14)
35 are shorter than the distance between two of the mutually adjacent slewing rings (7).

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Abstract

Insertion head having a twisting device for electrical components

Friction blocks (9), on which a slewing ring (7) of the gripper (5) rolls, are arranged along a movement path of the gripper (5), as a result of which the gripper (5) with the component (6) is twisted.

As a result, the component can be twisted into its approximate mounting position during the forward movement of the gripper, before the position measurement, saving time.

Figure 1

SUBSTITUTE SPECIFICATION:

SPECIFICATION

TITLE

"INSERTION HEAD HAVING A TWISTING DEVICE
FOR ELECTRICAL COMPONENTS"

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an insertion head having at least one twisting device for electrical components, the turret-like insertion head having a stator and a rotor, on which a large number of circularly distributed grippers are mounted such that they can rotate about a mounting axis, the insertion head having an optical measuring device for detecting the position of the components held on the grippers, and it being possible for the components to be twisted accurately into the required mounting position by a precision twisting device after being measured optically.

Description of the Related Art

European Patent Document EP-C 0 315 799 discloses providing an insertion device with a moveable turret head, in which the grippers provided with suction pipettes are arranged on a rotor such that they stand out in star fashion. A stator of the insertion head is provided with processing stations distributed circumferentially.

It is usual to design one of these stations as an optical measuring station, in which the rotational position of the component previously picked up is determined. In a subsequent twisting station, the position of the component is changed in accordance with the desired

installation position. This change includes a coarse twist, for example in 45° steps, corresponding to the desired installation position, and precision twisting, by means of which the fetching-in accuracy in picking up the components from a feed device is compensated for.

In addition, it is usual to provide the gripper with a disk-like slewing ring of relatively great diameter. On said ring, a friction wheel of the twisting device can be placed radially, whereupon the twisting device is activated and exact twisting of the gripper through a precalculated angle is effected. Since the components are to be placed onto the printed circuit board in different installation positions, the twisting angle may be so large that the entire twisting cycle lasts longer than the operating cycles on other stations of the turret head, which accordingly limits its insertion performance.

SUMMARY OF THE INVENTION

The invention is based on the object of reducing the time loss when twisting the grippers.

This object is achieved by the invention of an insertion head having at least one twisting device for electrical components, the turret-like insertion head having a stator and a rotor, on which a large number of circularly distributed grippers are mounted such that they can rotate about a mounting axis, the insertion head having an optical measuring device for detecting the position of the components held on the grippers, it being possible for the components to be twisted accurately into the required mounting position by a precision twisting device after being measured optically, wherein, before being measured, the components can be twisted into a position approximating the mounting position by means of

a coarse twisting device.

The rotation of the gripper is now distributed to two stages, the coarse twisting being carried out quickly without particular accuracy in a twisting segment before the optical measuring device. As a result, even in the case of a large overall twisting angle, the twisting angle in the precision twisting device can be shortened to such an extent that the precision adjustment does not last longer than, for example, than the optical measurement in the measuring device.

Advantageous developments of the invention provide that the rotor can be twisted step by step with respect to the stator, the optical measuring device is designed as a measuring station, and the precision twisting device is designed as a precision twisting station anchored to the stator. Specifically, the coarse twisting device anchored to the stator is designed as a coarse twisting station associated with a holding station for the grippers. The gripper having a slewing ring, which can be brought peripherally into frictional engagement with at least one friction surface on the twisting device, it being possible for the friction surface to be placed on the slewing ring in the radial direction and it being possible for the gripper to be twisted by means of a tangential relative movement between the twisting device and the slewing ring, wherein the stationary friction surface of the coarse twisting device extends along the movement path of the gripper that can be twisted together with the rotor, and the rolling length on the friction surface can be varied by means of the controlled feed of the friction surface onto the slewing ring. In one embodiment, the coarse twisting device permits a rotational adjustment of the gripper in coarse basic steps. The friction surface is formed on a radially adjustable friction block that is anchored to the stator. The segmented friction

surface is formed by a plurality of individually adjustable friction blocks, whose frictional length corresponds to the rotational angle of a basic step. Preferably, the friction surfaces are shorter than the distance between two of the mutually adjacent slewing rings.

The development providing that in that the rotor can be twisted step by step with respect to the stator, the optical measuring device is designed as a measuring station, and the precision twisting device is designed as a precision twisting station anchored to the stator means that the measurement and the precision twisting of the components take place at a standstill.

The measuring station and precision twisting station, and also the coarse twisting station which is anchored to the stator and associated with a holding station for the grippers are fixed to the stator in a simple way and can enter into a precise operative connection with the component or with the gripper.

By means of the frictional surface on the twisting device which extends along the movement path of the gripper that can be twisted together with the rotor and in by which the rolling length on the friction surface can be varied by means of the controlled feed of the friction surface onto the slewing ring, the coarse twisting is carried out without any time loss during the forward movement of the gripper which is required in any case. The stationary friction surface can be formed on a simple constructional part, on which the slewing ring rolls until the desired end position has at least approximately been reached. The length of the engagement between the friction surface and the slewing ring can be terminated accurately by means of a radial feeding movement of the twisting device, for example with the aid of piezoelectric drive elements with a short reaction time, so that the gripper can be twisted

through the calculated angle.

The development in which the coarse twisting device permits a rotational adjustment of the gripper in coarse basic steps makes it possible to carry out the coarse twisting with little control effort.

5 The friction block in which the friction surface is formed on a radially adjustable friction block that is anchored to the stator constitutes a simple component which is easy to operate.

The development that the segmented friction surface is formed by a plurality of individually adjustable friction blocks whose frictional length corresponds to the rotational
10 angle of a basic step makes it possible to design the length of the friction surfaces in such a way that a twisting angle of 45° , for example, is achieved at the gripper in each case. Multiplication of the twisting angle is made possible by an appropriate number of adjustable friction blocks which can be switched into the movement path of the slewing ring.

The development that the friction surfaces are shorter than the distance between two
15 of the mutually adjacent slewing rings ensures that the grippers with the slewing rings can be moved along a precisely defined path. For example, in the case of a stepper-like turret head with radially projecting grippers, the slewing rings move in one plane, so that the friction blocks can also be arranged in one plane, which is associated with mounting advantages. Shortening the frictional length ensures that each friction surface is in each case occupied by
20 only one slewing ring. As a result, the latter can be twisted differently and individually, as predefined.

Figure 1 shows a side view of an insertion head for populating electrical printed circuit boards with components, and

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The rotatably mounted grippers 5 are provided with slewing rings 7 shaped like disks. An optical measuring station 8 is used to measure the position of the components 6 with respect to the gripper 5. Fitted to the stator 2, along the movement path of the slewing rings 7, are friction blocks 9, which can be deflected in the horizontal arrow direction to such an extent that their friction surfaces 14 can be placed on the slewing rings 7. When the rotor 3 is twisted, the slewing rings 7 therefore roll with their outer surfaces on the friction surfaces 14

and are accordingly twisted. This twisting takes place in a time-saving manner between the holding stations of the rotor 3. The length of the friction blocks 9 is such that the grippers 5 are in each case twisted through 45°, for example.

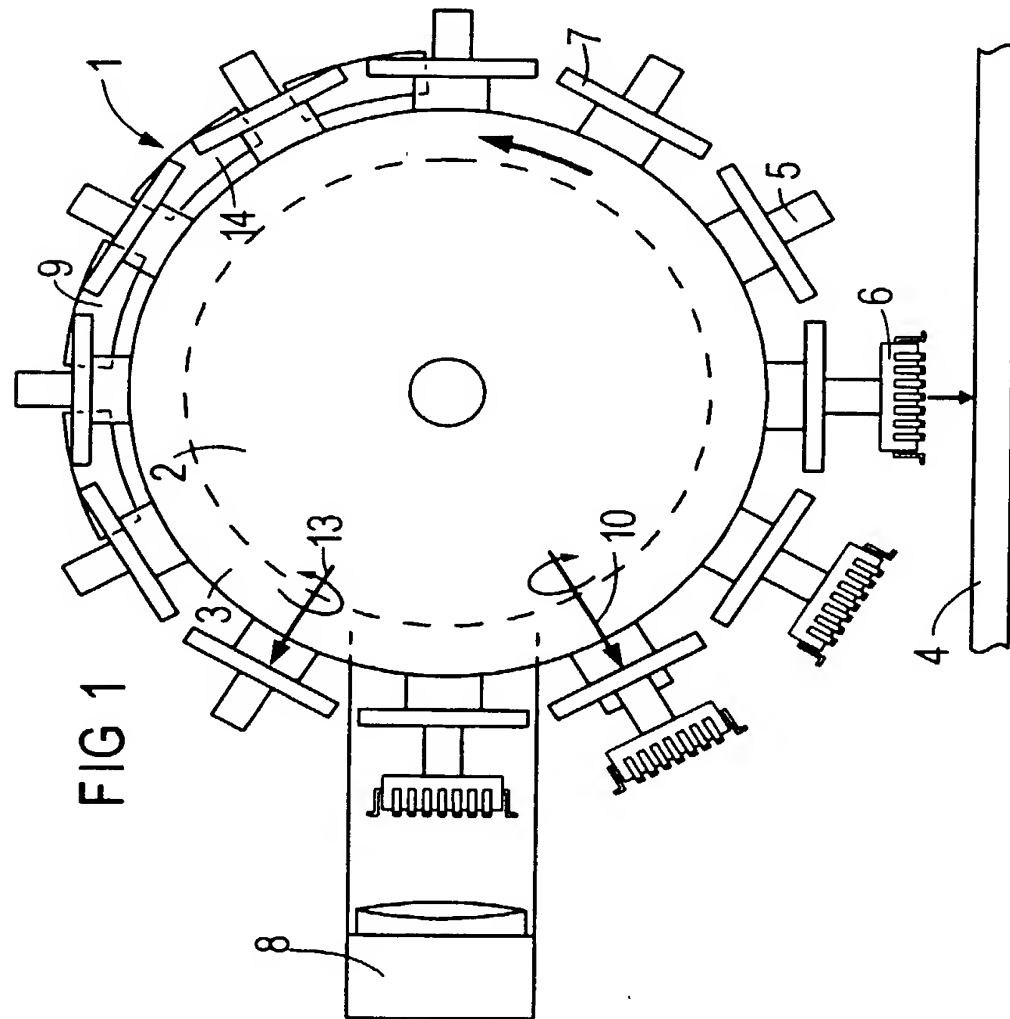
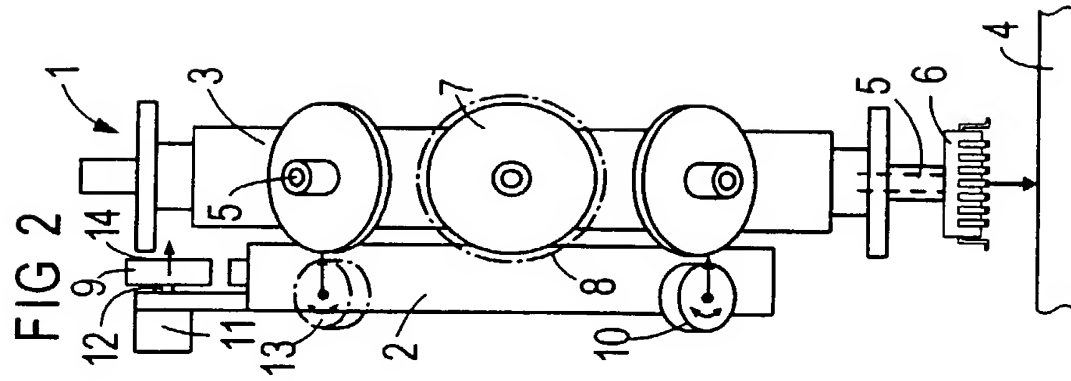
By switching the braking-block feed on and off, the gripper can be twisted by any
5 desired multiple of the coarse twisting angle. Following this coarse twisting, the components 6 are measured in the optical station, and their deviation from the installation position is determined. A subsequent precision twisting device 10 is associated with one of the holding stations. In said device, the rotational position of the gripper 5 can be changed in fine steps, and the desired installation position of the component can also be corrected.

10 The friction blocks 9 are part of a coarse twisting device 11 and are connected to the latter via piezoelectric drive elements 12, which adjust the friction block 9 in the direction of the slewing ring 7.

Instead of the coarse twisting device 11 with the friction blocks 8, a coarse twisting
15 station (13), indicated by dash-dotted lines, can also be arranged on the stator of a holding station of the grippers 5, being of the same construction as the precision twisting station 10.

Although other modifications and changes may be suggested by those skilled in the art, it is the intention of the inventors to embody within the patent warranted hereon all changes and modifications as reasonably and properly come within the scope of their contribution to the art.

1/1



Declaration and Power of Attorney For Patent Application

Erklärung Für Patentanmeldungen Mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Bestückkopf mit einer Verdreheinrichtung für elektrische Bauelemente

Insertion head with a twisting device for electrical components

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)

(check one)

☐ hier beigefügt ist.

☐ is attached hereto.

☒ am 03.04.2000 als

☒ was filed on 03.04.2000 as

PCT internationale Anmeldung

PCT international application

PCT Anmeldungsnummer PCT/DE00/01025

PCT Application No. PCT/DE00/01025

eingereicht wurde und am

and was amended on

abgeändert wurde (falls tatsächlich abgeändert).

(if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

German Language Declaration

Prior foreign applications
Priorität beansprucht

Priority Claimed

19918056.3

(Number)
(Nummer)

DE

(Country)
(Land)

21.04.1999

(Day Month Year Filed)
(Tag Monat Jahr eingereicht)

☒

Yes
Ja

☐

No
Nein

19961778.3

(Number)
(Nummer)

DE

(Country)
(Land)

21.12.1999

(Day Month Year Filed)
(Tag Monat Jahr eingereicht)

☒

Yes
Ja

☐

No
Nein

(Number)
(Nummer)

(Country)
(Land)

(Day Month Year Filed)
(Tag Monat Jahr eingereicht)

☐

Yes
Ja

☐

No
Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

PCT/DE00/01025

(Application Serial No.)
(Anmeldeseriennummer)

03.04.2000

(Filing Date D, M, Y)
(Anmeldedatum T, M, J)

anhängig

(Status)
(patentiert, anhängig,
aufgegeben)

pending

(Status)
(patented, pending,
abandoned)

(Application Serial No.)
(Anmeldeseriennummer)

(Filing Date D,M,Y)
(Anmeldedatum T, M; J)

(Status)
(patentiert, anhängig,
aufgeben)

(Status)
(patented, pending,
abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt: (Name und Registrationsnummer anführen)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Customer No. 26574

And I hereby appoint

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(Name und Telefonnummer)

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Ext. _____

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Telephone: (001) 312 258 5780 and Facsimile (001) 312 258 5921
or
Customer No. 26574

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<u>81379 MUENCHEN</u>		<u>81379 MUENCHEN</u>	
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Unterschrift des Erfinders <u>X M. Mehdianpour</u>	Datum <u>04.10.01</u>	Second Inventor's signature	Date
Wohnsitz <u>MUENCHEN, DEUTSCHLAND <u>DEX</u></u>		Residence <u>MUENCHEN, GERMANY</u>	
Staatsangehörigkeit <u>IR</u>		Citizenship <u>IR</u>	
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<u>81829 MUENCHEN</u>		<u>81829 MUENCHEN</u>	

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(Supply similar information and signature for third and subsequent joint inventors).

1005 100
300

Voller Name des dritten Miterfinders: RALE SCHULZ		Full name of third joint inventor: RALF SCHULZ	
Unterschrift des Erfinders <i>[Signature]</i> Datum 26.09.01		Inventor's signature _____ Date _____	
Wohnsitz MUENCHEN, DEUTSCHLAND <i>[Signature]</i>		Residence MUENCHEN, GERMANY	
Staatsangehörigkeit DE		Citizenship DE	
Postanschrift HAIDELWEG 25		Post Office Address HAIDELWEG 25	
81241 MUENCHEN		81241 MUENCHEN	
Voller Name des vierten Miterfinders:		Full name of fourth joint inventor:	
Unterschrift des Erfinders _____ Datum _____		Inventor's signature _____ Date _____	
Wohnsitz _____		Residence _____	
Staatsangehörigkeit _____		Citizenship _____	
Postanschrift _____		Post Office Address _____	
Voller Name des fünften Miterfinders:		Full name of fifth joint inventor:	
Unterschrift des Erfinders _____ Datum _____		Inventor's signature _____ Date _____	
Wohnsitz _____		Residence _____	
Staatsangehörigkeit _____		Citizenship _____	
Postanschrift _____		Post Office Address _____	
Voller Name des sechsten Miterfinders:		Full name of sixth joint inventor:	
Unterschrift des Erfinders _____ Datum _____		Inventor's signature _____ Date _____	
Wohnsitz _____		Residence _____	
Staatsangehörigkeit _____		Citizenship _____	
Postanschrift _____		Post Office Address _____	

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).